IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

APPEAL BRIEF FOR THE APPELLANT

Ex parte MASAKA

MANUFACTURING PROCESS FOR MEMBRANE-ELECTRODE ASSEMBLIES

Application No.: 10/773,317
Filed: February 9, 2004
Appeal No.: Not Yet Assigned
Group Art Unit: 1745
Examiner: Ben LEWIS

Submitted herewith is an Appeal Brief. The period for response is extended one month, from December 16, 2007, to January 16, 2008, with payment of the appropriate fees. Please charge any fee deficiencies required with respect to this paper, or credit any overpayment to our Deposit Account No. 01-2300, referencing Attorney Docket Number **026035-00010**.

Respectfully submitted,

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THE HONORABLE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the application of:

MASAKA et al.

Application No.: 10/773,317

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Attorney Docket No.: 026035-00010

For: MANUFACTURING PROCESS FOR MEMBRANE-ELECTRODE ASSEMBLIES

BRIEF ON APPEAL

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I. INTRODUCTION

This is an appeal from the Final Office Action dated April 19, 2007 finally rejecting pending claims 1, 2, 4, 5, 9-12, 14 and 15 under 35 U.S.C. §103(a) as being unpatentable over Nanaumi et al. (U.S. Patent Publication No. 2002/0155340 A1, hereinafter "Nanaumi") in view of Sompalli et al. (U.S. Patent No. 6,524,736, hereinafter "Sompalli"). Claim 6 is rejected under 35 U.S.C. §103(a) as being unpatentable over Nanaumi in view of Sompalli, as applied to claim 4 above, and further in view of Yamakawa et al. (U.S. Publication No. 2003/0173547, hereinafter "Yamakawa"). Claim 8 is rejected under 35 U.S.C. §103(a) as being unpatentable over Nanaumi in view of Sompalli, and further in view of Sansone et al. (U.S. Patent No. 6,187,231, hereinafter "Sansone"). Claim 13 is rejected under 35 U.S.C. §103(a) as being unpatentable over Nanaumi in view of Sompalli, and further in view of Sansone.

A Notice of Appeal was timely filed on October 16, 2007 with a three-month Petition for Extension of Time. Accordingly, the Appellant timely files this Appeal Brief.

II. REAL PARTY IN INTEREST

The real parties in interest in the present application are JSR Corporation and Honda Motor Company, both corporations of Japan, as evidenced by the assignment recorded at the United States Patent and Trademark Office on February 9, 2004 at Reel 014969, Frame 0911.

III. RELATED APPEALS AND INTERFERENCES

The Appellant, Appellant's legal representative, and assignees are not aware of any related appeals or interferences that will directly affect, be directly affected by, or have a bearing on the Board's decision in the pending appeal.

IV. STATUS OF CLAIMS

Claims 1, 2, 4-6, and 8-15 are pending and rejected. Claims 1, 2, 4-6, and 8-15 are being appealed. A copy of the claims under appeal is presented in Appendix I.

V. STATUS OF AMENDMENTS

The amendments submitted on August 23, 2007 in reply to the Final Office Action have not been entered. The instant Appeal Brief is based upon the claims as finally rejected.

VI. SUMMARY OF THE CLAIMED SUBJECT MATTER

The subject matter of independent claim 1 and associated dependent claims 2, 4-6, 8-11, and 14-15 is directed to at least a process of manufacturing membrane electrode assemblies comprising forming an electrolyte membrane by a film casting method in which a solution of a proton conductive polymer in a first organic solvent is flow cast on a film-casting substrate to form a wet film (See Specification, p. 3, lines 15-18). The process further includes obtaining the electrolyte membrane by reducing an amount of residual solvent in the wet film (See Specification, p. 32, lines 8-10), so that the electrolyte membrane contains residual solvent in an amount of 5 parts by weight or less based on 100 parts by weight of the proton conductive polymer (See Specification, p. 3, lines 18-21). In addition, the process includes pressure bonding the electrolyte membrane with electrode substrates to form a membrane-electrode assembly (See Specification, p. 3, lines 5-7), where a second solvent is applied to at least one of facing surfaces of the opposed electrode substrate and the electrolyte membrane prior to the pressure bonding (See Specification, p. 3, lines 7-10 and p. 36, lines 9-12). The second solvent is applied in an amount of from 0.001 mg/cm^2 to 10 mg/cm^2 (See Specification, p. 36, lines 18-19). The electrolyte membrane may include a sulfonated polyarylene (See Specification, p. 4, lines 4-5). The amount of residual solvent in the wet film may be reduced by soaking the wet film in water (See Specification, p. 32, lines 6-9).

The subject matter of independent claim 12 is directed to at least a process of manufacturing membrane-electrode assemblies, comprising forming an electrolyte membrane by producing a wet electrolyte membrane film by a film casting method in which a solution of a proton conductive polymer in a first organic solvent is flow cast on a film-casting substrate (See Specification, p. 3, lines 15-18). The process further includes reducing an amount of residual solvent in the wet electrolyte membrane film to form the electrolyte membrane (See Specification, p. 32, lines 8-10). In addition, the electrolyte membrane is pressure bonded with electrode substrates to form a membrane-electrode assembly (See Specification, p. 3, lines 5-7). A second solvent is applied to at least one of facing surfaces of the opposed electrode substrate and the electrolyte membrane prior to the pressure bonding (See Specification, p. 3, lines 7-10 and p. 36, lines 9-12).

The subject matter of independent claim 13 is directed to at least a process of manufacturing membrane-electrode assemblies comprising forming an electrolyte membrane by producing a wet electrolyte membrane film by a film casting method in which a solution of a proton conductive polymer in a first organic solvent is flow cast on a film-casting substrate (See Specification, p. 3, lines 15-18). The process further includes reducing an amount of residual solvent in the wet electrolyte membrane film by soaking in water (See Specification, p. 32, lines 6-9). In addition, the soaked, wet electrolyte membrane film is dried to form the electrolyte membrane (See Specification, p. 34, lines 1-2). Then the electrolyte membrane is pressure bonded with electrode substrates to form a membrane-electrode assembly (See Specification, p. 3, lines 5-7). A second solvent is applied to at least one of facing surfaces of the opposed electrode substrate and the electrolyte membrane prior to the pressure bonding (See Specification, p. 3, lines 7-10 and p. 36, lines 9-12).

VII. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1, 2, 4, 5, 9-12, 14 and 15 stand finally rejected under 35 U.S.C. §103(a) as being unpatentable over Nanaumi in view of Sompalli. Claim 6 stands finally rejected under 35 U.S.C. §103(a) as being unpatentable over Nanaumi in view of

Sompalli, as applied to claim 4 above, and further in view of Yamakawa. Claim 8 stands finally rejected under 35 U.S.C. §103(a) as being unpatentable over Nanaumi in view of Sompalli, and further in view of Sansone. Claim 13 stands finally rejected under 35 U.S.C. §103(a) as being unpatentable over Nanaumi in view of Sompalli, and further in view of Sansone.

VIII. ARGUMENT

A. Legal Overview

When rejecting claims under 35 U.S.C. § 103, the Examiner bears the initial burden of presenting a *prima facie* case of obviousness. If the Examiner fails to establish a *prima facie* case, the rejection is improper and will be overturned. See *In re Rijckaert*, 9 F.3d 1531, 28 U.S.P.Q. 2d. 1955 (Fed. Cir. 1993). "If examination.... does not produce a prima facie case of unpatentability, then without more the Appellant is entitled to the grant of the patent." *In re Oetiker*, 977 F.2d 1443, 1445-1446, 24 U.S.P.Q.2d. 1443, 1444 (Fed. Cir. 1992).

The Appellants respectfully submit that the specific factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 117, 148 U.S.P.Q. 459 (1966), have not been considered or properly applied by the Examiner. Particularly, the differences between the references and the claims were not properly determined. Therefore, the rejection is improper, and should be withdrawn.

Several basic factual inquiries must be made to determine obviousness or non-obviousness of patent application claims under 35 U.S.C. § 103. These factual inquiries are set forth in *Graham*:

> Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; the level of ordinary skill in the pertinent art resolved. Against this backdrop, the obviousness or non-obviousness of the subject matter is determined.

Graham v. John Deere Co., 383 U.S. 1, 18 (1966).

As stated by the Federal Circuit in *In re Ochiai*, 71 F.3d 1565, 37 U.S.P.Q. 2d 1127 (Fed. Cir. 1995):

> The test of obviousness *vel non* is statutory. It requires that one compare the claim's subject matter as a whole with a prior art to which the subject matter pertains. 35 U.S.C. § 103.
>
> The inquiry is **highly fact-specific by design**.... When the references cited by the Examiner fail to establish a *prima facie* case of obviousness, the rejection is improper and will be overturned. *In re Fine*, 837 F.2d 1071, 1074, 5 U.S.P.Q. 2d 1596, 1598 (Fed. Cir. 1988).

In re Ochiai, 71 F.3d at 1569 (emphasis added).

A *prima facie* case of obviousness is established only if the teachings of the prior art would have suggested the claimed subject matter to a person of ordinary skill in the art. The proper analysis is whether the claimed invention would have been obvious to one of ordinary skill in the art after consideration of all the facts. See *Examination Guidelines for Determining Obviousness Under 35 U.S.C. 103 in View of the Supreme Court Decision in KSR International Co. v. Teleflex Inc.*, Federal Register/Vol. 72, No. 195/Wednesday, October 10, 2007/Notices, p. 57528.

As stated by the USPTO in the *Examination Guidelines,* "[t]he key to supporting any rejection under 35 U.S.C. 103 is the clear articulation on the reason(s) why the claimed invention would have been obvious." See *Examination Guidelines* at 57528. In *KSR International Co. v. Teleflex Inc.*, 550 U.S. _, 82, USPQ.2d 1385 (2007), the Supreme Court, quoting *In Re Kahn*, stated that "[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness (See *In re Kahn*, 441 F.3d 977, 988 (CA Fed. 2006).

Further, in *KSR*, the Supreme Court held that "[t]he obviousness analysis cannot be confined by a formalistic conceptions of the words teaching, suggestion, and motivation, or by overemphasis on the importance of published articles and the explicit

content of issued patents." In the *Examination Guidelines for Determining Obviousness*, the USPTO outlined several rationales for finding obviousness. These rationales include (A) combining prior art elements according to known methods to yield predictable results; (B) simple substitution of one known element for another to obtain predictable results; (C) use of known technique to improve similar devices (methods, or products) in the same way; (D) applying a known technique to a known device (method, or product) ready for improvement to yield predictable results; (E) "obvious to try" – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; (F) known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable in the art; (G) some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention. See *Examination Guidelines* at 57529.

The Appellants respectfully submit that the Examiner has not made a proper *prima facie* rejection under 35 U.S.C. §103, because the combination of prior art references cited fail to teach or suggest all the features of the present invention as claimed. Moreover, NONE of the rationales outlined above support the rejections under §103.

B. The Cited Prior Art Fails to Teach or Suggest All Claim Elements

1. *Rejection of Claims 1, 2, 4, 5, 9-12, 14 and 15*

Claims 1, 2, 4, 5, 9-12, 14 and 15 stand finally rejected under 35 U.S.C. §103(a) as being unpatentable over Nanaumi and further in view of Sompalli.

a. Rejection of Independent Claims 1 and 12

Claim 1 recites:

> A process of manufacturing membrane-electrode assemblies, said process comprising forming an electrolyte membrane by a film casting method in which a solution of a proton conductive polymer in a first organic solvent is flow cast on a film-casting substrate to

> form a wet film, and the electrolyte membrane is obtained by reducing an amount of residual solvent in the wet film, wherein the electrolyte membrane contains residual solvent in an amount of 5 parts by weight or less based on 100 parts by weight of the proton conductive polymer; pressure bonding said electrolyte membrane with electrode substrates to form a membrane-electrode assembly, **wherein a second solvent is applied to at least one of facing surfaces of the opposed electrode substrate and the electrolyte membrane prior to the pressure bonding**; wherein the second solvent is applied in an amount of from 0.001 mg/cm^2 to 10 mg/cm^2. (emphasis added)

Claim 12 recites:

> A process of manufacturing membrane-electrode assemblies, said process comprising forming an electrolyte membrane by (a) producing a wet electrolyte membrane film by a film casting method in which a solution of a proton conductive polymer in a first organic solvent is flow cast on a film-casting substrate, and (b) reducing an amount of residual solvent in the wet electrolyte membrane film to form the electrolyte membrane; then pressure bonding said electrolyte membrane with electrode substrates to form a membrane-electrode assembly, **wherein a second solvent is applied to at least one of facing surfaces of the opposed electrode substrate and the electrolyte membrane prior to the pressure bonding**. (emphasis added)

The Specification at page 35, lines 15-17 discusses that a second solvent is applied to at least one of the facing surfaces of the electrode substrate and electrolyte membrane prior to bonding to provide adhesion to form a satisfactory membrane-electrode assembly.

Primary reference Nanaumi is directed to a membrane electrode assembly that includes a polymer electrolyte membrane and electrodes having catalytic layers bonded to both surfaces of the electrolyte membrane (See paragraph [0010]). To form the polymer electrolyte membrane in Nanaumi, the electrode is first formed by preparing a gas-diffusion layer on a support substrate (See paragraph [0065]). A catalyst slurry is then coated on the gas-diffusion layer to produce a catalytic layer of the electrode (See paragraph [0067]).

In a first approach, a solution of a polymer electrolyte in an organic solvent is directly applied to the catalytic layer of the electrode (See paragraphs [0070]-[0072]). The Appellants note that no solvent is applied to the catalytic layer before applying the polymer electrolyte solution. When the concentration of the organic solvent remaining in the polymer electrolyte membrane becomes 5-20 weight%, the catalyst slurry for the other electrode is applied to the surface of the membrane (See paragraph [0072]). Again, the Appellants note that no solvent is applied to the polymer electrolyte membrane before applying the catalyst slurry for the second electrode.

In a second approach of Nanaumi, a solution of a sulfonated hydrocarbon polymer in an organic solvent is formed into a membrane (See paragraph [0076]). The amount of organic solvent remaining in the membrane is preferably adjusted to 3-20 weight% (See paragraph [0077]). The resulting polymer electrolyte membrane is sandwiched between an oxygen electrode and a fuel electrode, prepared as described above (See paragraph [0078]). The Appellants also note that in the second approach, no solvent is applied in between the polymer electrolyte membrane and the oxygen and fuel electrodes.

Accordingly, Nanaumi does not teach or suggest the application of a second solvent to at least one facing surface of an electrode substrate and the electrolyte membrane prior to pressure bonding, as specifically claimed.

In making the rejection, the Examiner takes the position that Nanaumi discloses most, i.e. not all, aspects of the claimed invention. The Examiner admits that Nanaumi does not specifically teach wherein a second solvent for the electrolyte membrane is applied to at least one of the facing surfaces of the opposed electrode substrate and the electrolyte membrane prior to pressure bonding, as recited in claims 1 and 12 (See Final Office Action, p. 3).

The Examiner cites Sompalli as allegedly curing this deficiency, stating on pages 3-4 of the Final Office Action:

> Sompalli et al. teach methods of preparing membrane electrode assemblies wherein in the pretreatment approach, a porous support substrate is coated with a wetting solvent such that the solvent is imbibed into the pores. A slurry is formed including an ionically conductive material, a catalyst supported on an electrically

> conductive material, and a solvent that is non-wetting to the porous substrate. The slurry is well mixed and applied as a layer to the surface of the porous support substrate and dried to form a film. The film is applied to a membrane, and heat and pressure are applied to form a membrane electrode assembly. Advantageously, this method controls the drying to form a more robust electrode by preventing electrode shrinkage and subsequent cracking of the electrodes (Col 1 lines 45-67). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the coating of the electrode substrate with a second solvent of Sompalli et al into the MEA manufacturing process of Nanaumi et al. because Sompalli et al teach that advantageously, this method controls the drying to form a more robust electrode by preventing electrode shrinkage and subsequent cracking of the electrodes (Col 1 lines 45-67)."

As quoted above, the Examiner relies on the "pretreatment process" described in Col. 1, lines 45-67 of Sompalli for teaching step of applying a second solvent to at least one facing surface of an electrode substrate and the electrolyte membrane (See also Continuation Sheet of Advisory Action issued September 19, 2007). However, the Appellants respectfully submit that this reliance is misguided. The step relied upon relates to how to form the initial electrode. Contrary to the Examiner's assertion, secondary reference Sompalli does not cure the defects of primary reference Nanaumi. Nowhere in the pretreatment process or elsewhere in the patent does Sompalli teach or suggest applying a solvent to the membrane or the electrode prior to pressure bonding.

Instead, Sompalli's pretreatment process entails forming an electrode on a substrate by applying a catalyst slurry containing a solvent, which evaporates to form the electrode film (See Col. 6, lines 6-10). The thus-formed film is then applied to a membrane, and heat and pressure are applied to form a membrane electrode assembly (See Col. 1, lines 65-67 and Col. 6, lines 45-53). Sompalli describes the process of bonding the electrode to the membrane as a "decal" transfer process in which the electrode is applied to the membrane by hot pressing (See Col. 7, lines 41-66). Nowhere in this process does Sompalli teach that a solvent is applied to at least one of the membrane and the electrode decal prior to pressure bonding.

The Appellants submit that the process resulting from the combination of Nanaumi and Sompalli is not the process of manufacturing membrane-electrode

assemblies recited in claims 1 and 12 at least because it does not include the application of a solvent to at least one facing surface of an electrode substrate and the electrolyte membrane before pressure bonding them together.

Further, independent claims 1 and 12 are not obvious over the proposed combination of Nanaumi and Sompalli because the Examiner has not provided a valid reason or way for combining the references to arrive at the presently-claimed invention. The Appellants submit that even if Nanaumi and Sompalli are combined, there is no teaching or suggestion of applying a solvent to at least one of the membrane and the electrode prior to pressure bonding. Moreover, one skilled in the art having the disclosures of Nanaumi and Sompalli before him would not be motivated to modify their disclosures to arrive at the presently-claimed invention since there is not even a hint of applying a solvent to at least one facing surface of an electrode substrate and the electrolyte membrane before pressure bonding in either reference.

The Examiner has failed to provide a valid prior art reference that teaches or suggests the step of applying a solvent to at least one facing surface of an electrode substrate and the electrolyte membrane before pressure bonding them together. As such, the Appellants respectfully submit that the Examiner has failed to meet his burden of presenting a *prima facie* case of obviousness. As the Federal Circuit stated in *In re Rijckaert*, 9 F.3d 1531, 28 U.S.P.Q.2d 1955 (Fed. Cir. 1993):

> "In rejecting claims under 35 U.S.C. 103, the examiner bears the initial burden of presenting a *prima facie* case of obviousness...Only if that burden is met does the burden of coming forward with evidence or argument shift to the applicant...'A *prima facie* case of obviousness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art...If the examiner fails to establish a *prima facie* case, the rejection is improper and will be overturned.'"

For at least the above reasons, the Appellants respectfully request this Board to reverse the Examiner with respect to the rejection of claims 1 and 12 under 35 U.S.C. §103(a) over Nanaumi in view of Sompalli.

b. Rejection of Dependent Claims 2, 4, 5, 9-11, 14 and 15

Claims 2, 4, 5, 9-11, 14 and 15 depend from independent claim 1, and as such, they incorporate all the features of claim 1. As the Appellants argued above, the proposed combination of Nanaumi and Sompalli fails to teach or suggest at least the step of applying a second solvent to at least one facing surface of an electrode substrate and the electrolyte membrane prior to pressure bonding, as recited in claims 1 and 12. Thus, the Appellants submit that, contrary to the Examiner's assertions, claims 2, 4, 5, 9-11, 14 and 15 are not obvious over Nanaumi in view of Sompalli.

For at least the above reasons, the Appellants respectfully request this Board to reverse the Examiner with respect to the rejection of claims 2, 4, 5, 9-11, 14 and 15 under 35 U.S.C. §103(a) over Nanaumi in view of Sompalli.

2. *Rejection of claim 6*

Claim 6 stands finally rejected under 35 U.S.C. §103(a) as being unpatentable over Nanaumi in view of Sompalli as applied to claim 4 above, and further in view of Yamakawa.

Claim 6, which depends from claim 4, recites the process of manufacturing membrane-electrode assemblies of claim 1, wherein the electrolyte membrane comprises a sulfonated polyarylene (See Specification, p. 4, lines 4-5).

In making this rejection, the Examiner takes the position that Nanaumi as modified by Sompalli discloses a membrane electrode assembly of claim 1 (See Final Office Action, p. 7). In so doing, the Examiner admits that, "Nanaumi et al. as modified by Sompalli et al. do not specifically teach that the sulfonated aromatic polymer is a sulfonated aromatic polymer (sic). However, Yamakawa disclose a halogenated aromatic compound, (co)polymer thereof, and proton-conductive membrane comprising the same (title) wherein the proton-conductive membrane comprising the sulfonated polyarylene (co)polymer according to the invention can realize a proton conductivity

equal to that conventionally sulfonated (co)polymers even at a low sulfonic acid group equivalent."

As the Appellants argued above, claim 1 is not obvious over the combination of Nanaumi and Sompalli. Further, Yamakawa fails to cure the defects of Nanaumi and Sompalli. In particular, the Appellants submit that Yamakawa fails to teach or suggest at least the process step of applying a second solvent to at least one facing surface of an electrode substrate and the electrolyte membrane prior to pressure bonding, as recited in claim 1.

Since claim 6 depends from claim 1, it incorporates all of its features. For at least the above reasons, the Appellants respectfully submit that claim 6 is not obvious over the proposed combination of Nanaumi, Sompalli, and Yamakawa. Accordingly, the Appellants respectfully request this Board to reverse the Examiner with respect to the rejection of claim 6 under 35 U.S.C. §103(a) over Nanaumi in view of Sompalli, and further in view of Yamakawa.

3. *Rejection of Claim 8 Under 35 U.S.C. § 103(a)*

Claim 8 stands finally rejected under 35 U.S.C. §103(a) as being unpatentable over Nanaumi in view of Sompalli, and further in view of Sansone.

Claim 8 recites the process of claim 1, wherein the amount of residual solvent in the wet film is reduced by soaking the wet film in water (See Specification, p. 32, lines 6-9).

In making this rejection, the Examiner takes the position that Nanaumi and Sompalli disclose a membrane electrode assembly of claim 1. The Examiner admits that Nanaumi as modified by Sompalli do not specifically teach or suggest that the residual solvent in the wet film is reduced by soaking the wet film in water (See Final Office Action, p. 8). However, the Examiner relies on Sansone for disclosing a process for producing polymeric films for use in fuel cells wherein after forming the membrane in a coagulation bath, the resulting membrane is submerged into a non-solvent bath, such as water or methanol, or a bath formed of a mixture of non-solvents to remove any

residual solvent (See Final Office Action, p. 8-9). The Examiner further asserts that it would have been obvious to one of ordinary skill in the art to combine the teachings of Nanaumi, Sompalli and Sansone to use water to remove excess solvent, as recited in claim 8.

As the Appellants argued above, claim 1 is not obvious over the combination of Nanaumi and Sompalli. Further, Sansone fails to cure the defects of Nanaumi and Sompalli. In particular, Sansone does not teach or suggest at least the process step of applying a second solvent to at least one facing surface of an electrode substrate and the electrolyte membrane prior to pressure bonding, as recited in claim 1.

Since claim 8 depends from claim 1, it incorporates all of its features. For at least the above reasons, the Appellants respectfully submit that claim 8 is not obvious over the proposed combination of Nanaumi, Sompalli, and Sansone. Accordingly, the Appellants respectfully request this Board to reverse the Examiner with respect to the rejection of claim 8 under 35 U.S.C. §103(a) over Nanaumi in view of Sompalli, and further in view of Yamakawa.

4. *Rejection of Claim 13 Under 35 U.S.C. § 103(a)*

Claim 13 stands finally rejected under 35 U.S.C. §103(a) as being unpatentable over Nanaumi in view of Sompalli, and further in view of Sansone.

Claim 13 recites:

> A process of manufacturing membrane-electrode assemblies, said process comprising forming an electrolyte membrane by (a) producing a wet electrolyte membrane film by a film casting method in which a solution of a proton conductive polymer in a first organic solvent is flow cast on a film-casting substrate, (b) reducing an amount of residual solvent in the wet electrolyte membrane film by soaking in water, and (c) drying the soaked, wet electrolyte membrane film to form the electrolyte membrane; then pressure bonding said electrolyte membrane with electrode substrates to form a membrane-electrode assembly, **wherein a second solvent is applied to at least one of facing surfaces of the opposed electrode substrate and the electrolyte membrane prior to the pressure bonding**. (emphasis added)

In making this rejection, the Examiner takes the position that Nanaumi and Sompalli disclose a membrane electrode assembly as applied with respect to claims 1 and 12. The Examiner admits that Nanaumi as modified by Sompalli do not specifically teach that the residual solvent in the wet film is reduced by soaking the wet film in water (See Final Office Action, p. 9). The Examiner relies on Sansone for disclosing a process for producing polymeric films for use as fuel cells wherein after soaking in a coagulation bath, the resulting membrane is submerged into a non-solvent bath, such as water or methanol, or a bath formed of a mixture of non-solvents to remove any residual solvent. The Examiner further asserts that it would have been obvious to one of ordinary skill in the art to combine the teachings of Nanaumi, Sompalli and Sansone to use water to remove excess solvent, as recited in claim 13.

As the Appellants argued above, Nanaumi and Sompalli both fail to teach or suggest at least the step of applying a second solvent to at least one facing surface of an electrode substrate and the electrolyte membrane prior to pressure bonding. Further, Sansone fails to cure the defects of Nanaumi and Sompalli. In particular, Sansone does not teach or suggest at least the step of applying a second solvent to at least one facing surface of an electrode substrate and the electrolyte membrane prior to pressure bonding, as recited in claim 13. In addition, as discussed above, the Examiner has not provided a valid reason or way for combining Nanaumi, Sompalli, and Sansone to arrive at the presently-claimed invention. The Appellants submit that even if Nanaumi, Sompalli, and Sansone are combined, there is no teaching or suggestion of applying a solvent to at least one of the membrane and the electrode prior to pressure bonding.

Accordingly, Appellants respectfully submit that claim 13 is not obvious over the proposed combination of Nanaumi, Sompalli, and Sansone. For at least the above reasons, Appellants respectfully request this Board to reverse the Examiner with respect to the rejection of claim 13 under 35 U.S.C. §103(a) over Nanaumi in view of Sompalli, and further in view of Sansone.

5. *The Examiner has Failed to Establish Prima Facie Obviousness*

For at least the reasons set forth above in sections (1) to (4), the Appellants submit that the applied references fail to teach or suggest, either implicitly or explicitly, all of the elements of the presently claimed invention. Accordingly, the Appellants respectfully submit that the Examiner has failed to set forth a *prima facie* case of obviousness with respect to claims 1, 2, 4-6, and 8-15.

C. Sufficient Suggestion or Motivation to Combine the References Has Not Been Set Forth

In order to establish a prima facie case of obviousness, there must be some articulated reasoning with some rational underpinning to modify the reference or combine reference teachings. The Examiner cites as motivation for combining the Nanaumi and Sompalli references that, "it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the coating of the electrode substrate with a second solvent of Sompalli et al into the MEA fabrication process of Nanaumi et al. because Sompalli et al teach that advantageously, this method controls the drying to form a more robust electrode by preventing electrode shrinkage and subsequent cracking of the electrodes (Col 1 lines 45-67)" (See Final Office Action, page 4).

The Appellants respectfully submit that this statement does not articulate reasoning with a rational underpinning of how to combine the two references in order to teach or suggest all the elements of the presently claimed invention. The Examiner fails to show how a skilled artisan, presented with the specific problems encountered, without knowledge of the present invention, would select the specific features included in the present invention. The Appellants submit that the use of broad, vague statements

having nothing to do with the steps being claimed as a motivation to combine any two references circumvents the entire purpose of this requirement of the law.

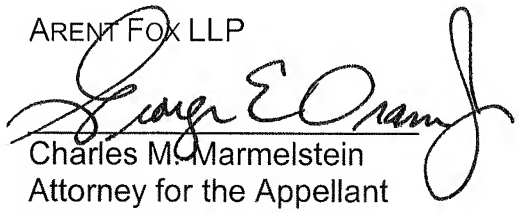
Accordingly, for all the reasons listed above, the Appellants submit that the Examiner has failed to establish a *prima facie* case of obviousness.

IX. CONCLUSION

The Appellants respectfully submit that claims 1, 2, 4-6, and 8-15 are not unpatentable under 35 U.S.C. § 103(a) and respectfully requests the Honorable Board to reverse the rejections.

Respectfully submitted,

ARENT FOX LLP



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X. APPENDIX I: COPY OF THE CLAIMS INVOLVED IN THE APPEAL

1. (Previously Presented) A process of manufacturing membrane-electrode assemblies, said process comprising

forming an electrolyte membrane by a film casting method in which a solution of a proton conductive polymer in a first organic solvent is flow cast on a film-casting substrate to form a wet film, and the electrolyte membrane is obtained by reducing an amount of residual solvent in the wet film, wherein the electrolyte membrane contains residual solvent in an amount of 5 parts by weight or less based on 100 parts by weight of the proton conductive polymer;

pressure bonding said electrolyte membrane with electrode substrates to form a membrane-electrode assembly,

wherein a second solvent is applied to at least one of facing surfaces of the opposed electrode substrate and the electrolyte membrane prior to the pressure bonding;

wherein the second solvent is applied in an amount of from 0.001 mg/cm^2 to 10 mg/cm^2.

2. (Previously Presented) The process as claimed in claim 1, wherein the second solvent for the electrolyte membrane is applied to both of the facing surfaces of the opposed electrolyte membrane and the electrode substrate.

3. (Cancelled)

4. (Previously Presented) The process as claimed in claim 1, wherein the electrolyte membrane comprises a sulfonated aromatic polymer.

5. (Previously Presented) The process as claimed in claim 4, wherein the second solvent for the electrolyte membrane is an aprotic dipolar solvent.

6. (Original) The process as claimed in claim 4, wherein the sulfonated aromatic polymer is a sulfonated polyarylene.

7. (Cancelled)

8. (Previously Presented) The process as claimed in claim 1, wherein the amount of residual solvent in the wet film is reduced by soaking the wet film in water.

9. (Previously Presented) The process as claimed in claim 1, wherein the second solvent for the electrolyte membrane is applied to at least the facing surface of the electrode substrate.

10. (Previously Presented) The process as claimed in claim 1, wherein a pressure in the pressure bonding is in the range of 0.5 to 20 MPa.

11. (Previously Presented) The process as claimed in claim 1, wherein the second solvent is applied in an amount of from 0.01 mg/cm^2 to 1 mg/cm^2.

12. (Previously Presented) A process of manufacturing membrane-electrode assemblies, said process comprising

forming an electrolyte membrane by (a) producing a wet electrolyte membrane film by a film casting method in which a solution of a proton conductive polymer in a first organic solvent is flow cast on a film-casting substrate, and (b) reducing an amount of residual solvent in the wet electrolyte membrane film to form the electrolyte membrane;

then pressure bonding said electrolyte membrane with electrode substrates to form a membrane-electrode assembly,

wherein a second solvent is applied to at least one of facing surfaces of the opposed electrode substrate and the electrolyte membrane prior to the pressure bonding.

13. (Previously Presented) A process of manufacturing membrane-electrode assemblies, said process comprising

forming an electrolyte membrane by (a) producing a wet electrolyte membrane film by a film casting method in which a solution of a proton conductive polymer in a first organic solvent is flow cast on a film-casting substrate, (b) reducing an amount of residual solvent in the wet electrolyte membrane film by soaking in water, and (c) drying the soaked, wet electrolyte membrane film to form the electrolyte membrane;

then pressure bonding said electrolyte membrane with electrode substrates to form a membrane-electrode assembly,

wherein a second solvent is applied to at least one of facing surfaces of the opposed electrode substrate and the electrolyte membrane prior to the pressure bonding.

14. (Previously Presented) The process as claimed in claim 1, wherein the second solvent has a dielectric constant of 20 or more.

15. (Previously Presented) The process as claimed in claim 1, wherein the second solvent is at least one selected from the group consisting of N,N-dimethylacetamide, N-methyl-2-pyrrolidone, γ-butyrolactone, tetramethylurea, dimethylsulfoxide, hexamethylphosphoric triamide and sulfolane.

XI. APPENDIX II: EVIDENCE

-- NONE –

XII. APPENDIX III: RELATED PROCEEDINGS

-- NONE --